**PSD Worksheet**

1) In “Direct observation of base-pair stepping of RNA polymerase,” by Abbondanzieri et al., Nature, 2005 the authors decrease the noise in their system in order to see 3 Angstrom movements of a biological molecule – RNA polymerase. Figure 1 (b) shows the power spectral density.

 a) The blue trace has what type of noise?

b) Both the blue and red trace have some common noise peaks. What frequencies are these peaks at? What could be a possible source for each?

c) What is the noise level for data taken over the frequency range 0.02-100 Hz for both the red and blue traces?

2) Figure below from: Noise and Vibration analysis by Anders Brandt.

 a) What type of noise is it?

 b) Assume the data is pure noise. What is the noise level from 5-15 Hz?

c) Assume that the signal is at 10 Hz and that the noise in the system is given by the baseline at 5 Hz. What is the signal to noise ratio?



**Answers:**

1) a) 1/f noise

 b) 7 and 20 and 80 Hz mechanical resonances, 60 Hz electronic noise

 c) blue = 1.1 Angstroms, red = 2.2 Angstroms

2) a) resonance peak

 b) estimate is σ= sqrt((5\*10^-3)+(5\*10^-1))

 c) S/N=sqrt(5\*10^-1)/sqrt(10\*10^-3)